

WASHINGTON STATE PATROL

BREATH TEST SECTION



BAC DATAMASTER

REPAIR/TROUBLESHOOTING GUIDE

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DATAMASTER TROUBLESHOOTING GUIDE

INTRODUCTION

As the field of breath testing continues to evolve, the BAC Datamaster continues to change and improve in design. Keeping up with design changes and new information necessitates periodic updates to manuals and forms. With this in mind, the Breath Test Section has decided to produce a standard troubleshooting guide. This is the first guide, it is expected that it will be updated, edited, and added to as time goes on and design improvements continue.

The information contained in this packet is a combination of data from various instrument manuals (from Verax Systems to National Patents) and information from several breath technicians from around the state. If you find a helpful hint that is not included in this guide, please forward the information Rich Bosman at the Burlington Office so we can share it in future updates.

Trooper Rich Bosman
Breath Technician - District Seven

DATAMASTER TROUBLESHOOTING GUIDE

FUNCTIONAL ERRORS

NO BREATH TUBE HEAT

1. Replace breath tube
2. Check wiring and connectors from sample chamber control board (SCCB) to breath tube
3. Replace SCCB
4. Replace power supply board (PSB) and/or PSB-SCCB cable

SAMPLE NOT ACCEPTING EVEN THOUGH "PLEASE BLOW" STOPS FLASHING

1. Perform electrical checks on SCCB
2. Check and/or replace breath block
3. Replace SCCB
4. Replace central processing unit (CPU)

INSTRUMENT SAMPLES EARLY, BY ITSELF, OR BLINKING DOES NOT STOP WHEN INSTRUMENT IS BLOWN INTO

1. Perform electrical checks on SCCB
2. Check or replace breath block and connection to SCCB
3. Replace SCCB
4. Replace PSB
5. Replace cable from SCCB to PSB
6. Replace CPU to PSB cable
7. Replace CPU

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DIFFICULTY IN ACCEPTING SAMPLE

1. Check thermistor and voltage
2. Increase 500mv/400mv setting to 510mv/410mv
3. Check if a piece of plastic is stuck on the thermistor

SUPERVISOR BUTTONS DO NOT FUNCTION

1. Check connections from CPU to display
2. Replace display
3. Replace CPU

PHYSICALLY DIFFICULT OR IMPOSSIBLE TO BLOW INTO INSTRUMENT

1. Check for obstructions (e.g. kinks in tubing, plastic in breath tube, etc.)
2. Check thermistor and voltage
3. Check 1-way valve
4. Replace 3/5-way valve
5. Replace CPU

NO DISPLAY

IF RED LIGHT (D6) on CPU LIGHTS UP

1. Ensure proper connection of CPU/Display cable
2. Replace display panel
3. Replace CPU

DATAMASTER TROUBLESHOOTING GUIDE

IF RED LIGHT (D6) ON CPU DOES NOT LIGHT UP

1. Check AC line fuse on back of instrument
2. Replace PSB
3. Replace CPU-PSB cable
4. Replace transformer

DISPLAY SHOWS DARK BAR ON UPPER HALF

1. Ensure proper connection of CPU/Display cable
- almost always the problem
2. Remove datamaster board from CPU. If problem is now gone, replace the datamaster board.
3. Replace display panel
4. Replace modem board
5. Replace CPU
6. Replace display cable
7. Replace printer cable
8. Replace printer board

NOT CALIBRATED

1. Recalibrate instrument
Anytime the CPU is removed from the instrument or a replacement CPU installed, the "Not Calibrated" message will appear and the instrument will need recalibration.
2. Check the CPU battery. Replace if low (less than 3.5v) or if more than five years old.
A low CPU battery can cause the instrument to lose calibration when power is interrupted or instrument turned off.

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PRINTER RUNS CONTINUOUSLY

1. Replace printer photo-interrupter
2. Replace printer driver board

MTR BUTTON DOES NOT FUNCTION

1. Unplug CPU-Detector cable at J25. If MTR button now works, replace the detector board.
2. Unplug SCCB-PSB cable at J3. If MTR now works, replace the SCCB.
3. Replace CPU

ERROR MESSAGES

TEMPERATURE LOW

1. Verify connector from breath block thermistor to SCCB is connected properly
2. Replace SCCB
3. Replace PSB
4. Replace SCCB-PSB cable
5. Replace CPU-PSB cable
6. Replace CPU
7. Replace sample chamber assembly

TEMPERATURE TOO HIGH

1. Make sure instrument has been warmed up at least 20 minutes.
2. Unplug CPU-Detector cable at J25. If problem is gone, replace the detector board.
3. Replace SCCB
4. Replace CPU
5. Replace PSB
6. Replace SCCB-PSB cable
7. Replace CPU-PSB cable

SYSTEM WON'T ZERO

1. Perform electrical checks for detector

DATAMASTER TROUBLESHOOTING GUIDE

SYSTEM WON'T ZERO - cont.

IF 120V DETECTOR CANNOT BE SET:

2. Replace detector board
3. Replace PSB
4. Replace CPU-Detector cable
5. Replace CPU-PSB cable
6. Replace CPU

IF COOLER CANNOT BE SET:

7. Check for short at cooler transistor on rear of case
 - a. Replace gasket and washers if necessary
 - b. Replace cooler transistor cable if ends frayed or shorted
 - c. Replace transistor if necessary
8. Replace cooler transistor
9. Replace detector board
10. Replace CPU
11. Replace Detector
12. Replace PSB
13. Replace CPU-Detector cable
14. Replace CPU-PSB cable
15. Check for physical blockages of the IR light
 - a. Simulator solution in the sample chamber, this can occur if the simulator is incorrectly hooked up to the instrument.
 - b. Cracked windows or mirrors
 - c. Chopper wheel not turning (a low hum can be heard when the motor is running)
 - d. Condensation buildup on the mirrors due to a leak in the system
 - e. Any other foreign substance in the sample chamber

DATA MASTER TROUBLESHOOTING GUIDE

SYSTEM WON'T ZERO - cont.

IF SOURCE LIGHT IS NOT EMITTING LIGHT:

Visual check (look if light visible) on old style lamps, check with multimeter (if voltage present) on new style lamps.

16. Replace source lamp
17. Check for short in lamp transistor connection at rear of case
 - a. Replace gasket and washers if necessary
 - b. Replace lamp transistor cable if ends frayed or shorted
 - c. Replace transistor if necessary
18. Replace SCCB
19. Replace SCCB-PSB cable
20. Replace PSB

IF ALCOHOL GAIN CANNOT BE ADJUSTED (OLDER DETECTOR BOARDS):

21. Replace detector board
22. Replace CPU
23. Replace CPU-Detector cable

IF ACETONE GAIN CANNOT BE ADJUSTED (OLDER DETECTOR BOARDS):

24. Replace detector board
25. Replace CPU
26. Replace CPU-Detector cable

IF 200 mVRMSAC DETECTOR SIGNAL CANNOT BE SET (OLDER DETECTOR BOARDS):

27. Try replacing the detector photo-interrupter. When the photo-interrupter is installed, rotate it until the most negative meter value is displayed.

DATAMASTER TROUBLESHOOTING GUIDE

PRINTER ERROR

1. Examine the printer. Often a bit of the ribbon is caught be the printer head, replacing the ribbon will correct the situation.
2. Verify 10-12V across C4 on the Printer Driver Board (should be about 12V, if higher than 13V - replace the PSB.)
3. Verify 12V at TP8 to ground on the Power Supply Board
4. Replace printer driver board
5. Replace printer
6. Replace the PSB-Printer board cable
7. Replace CPU

CRC ERROR

Make sure that the jumper is on the right two pins on both the CPU and the Datamaster boards.

IF THE CRC ERROR IS 800D:

Turn instrument off, wait 10 seconds then turn back on. If the message is still there:

1. Replace datamaster board
2. Replace CPU

IF THE CRC ERROR IS ANYTHING OTHER THAN 800D OR E87E:

3. Replace the datamaster board

IF THE CRC ERROR IS E87E:

4. Replace the CPU

DATA MASTER TROUBLESHOOTING GUIDE

PUMP ERROR

IF ERROR IS REPORTED AND PUMP DOES NOT COME ON:

1. Replace pump driver board
2. Check the inoperative pump by using the "Cal Cord", if pump will not run - replace the pump.
3. Replace the pump driver cable
4. Check the breath path for obstructions and make sure that all plumbing connections are secure. Verify proper operation of the 3/5-way valve by listening for a "click" sound coming from the valve when the instrument is first turned on.

IF NO "CLICK" SOUND IS HEARD:

5. Replace the 3/5-way valve
6. Replace the CPU

IF THE "CLICK" SOUND IS HEARD:

7. Check electrical settings on SCCB
8. Replace breath block assembly
9. Replace SCCB
10. Replace PSB-SCCB cable
11. Replace CPU-PSB cable
12. Replace CPU
13. Replace PSB

DATA MASTER TROUBLESHOOTING GUIDE

DIAGNOSTIC ERRORS

DETECTOR TOO LOW

Refer to "System Won't Zero" information in Error Messages Section

DETECTOR TOO HIGH

Refer to "System Won't Zero" information in Error Messages Section

PUMP ERROR

Refer to Pump Error information in Error Messages Section

FILTER ERROR

1. Ensure that filters are secure, clean, and not cracked, scratched or damaged.
2. Press MTR and note display. Manually pull in rear solenoid shaft and observe change in MTR value.

IF CHANGE IS LESS THAN .010:

Indicates filter incompatibility, install new set of filters or the entire detector block assembly.

IF CHANGE IS MORE THAN .010:

Follow "Quartz Standard Error" procedure

QUARTZ STANDARD ERROR

1. Verify proper electrical settings on CPU Board on CPU Board
2. Verify activation of front solenoid (Quartz Standard)
3. Replace CPU/Detector cable
4. Replace CPU
5. Replace Detector Board
6. Replace Detector Block Assembly

DATAMASTER TROUBLESHOOTING GUIDE

CALIBRATION ERROR

1. Attempt to recalibrate instrument
2. Verify operation of both solenoids during calibration
3. Verify Quartz Standard is clean and not cracked
4. Replace detector

DATAMASTER TROUBLESHOOTING GUIDE

DETECTOR

COOLER PROBLEMS

Cooler problems with detector could be cooler cable or cooler transistor

UNSTABLE METER

Unstable detector rarely the problem, usually a board or source lamp problem

Make sure lamp and lamp bracket are secure

Check phase loop lock circuit. Listen to chopper and disconnect J38, chopper should speed up or slow down, if not - replace detector board

COOLER VOLTAGE OSCILLATES

Bad detector

REPLACING THE DETECTOR

Whenever replacing the detector you must obtain a new cooler value. Procedure:

1. Instrument must be turned off for at least two hours
2. Find R26 on the board, is a large brown resistor next to the J36 plug. Hook the meter to the top (red) and the bottom (black) of the resistor.
3. Turn the instrument on. The meter value will fluctuate wildly before starting to settle down. Adjust the value to .475 (.165 "B" Boards) using R4.
4. Read the new value by hooking to TP4 (ground) and TP1 (red). Put a tag on the detector block listing the new value.

CHOPPER MOTOR NOISY Can try readjusting the motor. Use the set screw on top of detector block, do not overtighten. Usually have to replace the motor if noisy.

DATA MASTER TROUBLESHOOTING GUIDE

DETECTOR BOARD

TEMPERATURE HIGH
TEMPERATURE LOW
FATAL SYSTEMS
ERROR AT F060

If "Temperature High" or "Temperature Low" or "Fatal Systems Error at F060," unplug detector board-CPU cable. If error disappears, then the problem is at the detector board.

SYMPTOM 1.999

Check the J34 plug for proper connection, the cable could be offset one pin on the plug.

If you have 1.999 on voltage and the 120V setting is zero or very low, this is a problem with the power supply board not getting the correct voltage to the detector board, replace the PSB and that should correct it.

If you get the 200 mVRMSAC setting right and the 120V right and still have a 1.999, it is likely that the CPU is not correctly reading the information, try replacing the CPU

May be a bad photo-interrupter or a bad connection at J38 detector board. A photo-interrupter can be checked on the printer.

CHANGING FROM AN
OLD DETECTOR BOARD
TO AN "E" BOARD

When changing to a an "E" board, cut the diode off each solenoid. Remove photo-interrupter and use black tape to cover the hole. Obtain new cooler value. It is possible when changing board versions that the CPU will not read the voltage correctly and you may have to also replace the CPU. This is something to check if all other electricals look good and you continue to get a detector voltage of 1.999.

CHANGING FROM AN
"E" BOARD TO A
"B" DETECTOR BOARD

If you are changing from an "E" to a "B" board you may have to replace the CPU, it may not be correctly interpreting the voltage with the "B" board. This is a good thing to check if all the other voltages (including 200 mVRMSAC) are correct and the detector voltage stays at 1.999.

DATAMASTER TROUBLESHOOTING GUIDE

DETECTOR BOARD - cont.

CHECKING LAMP VOLTAGE FROM THE "E" BOARD

Connect black lead to TP4 and red to TP2, set the meter for "AC". Should read near 200 mVRMSAC you will not be able to adjust it but it will give you a good idea of lamp/SCCB output and condition.

CONNECTORS

J37 - six pin cable to detector board:

Three Circuits:

1. Thermistor Circuit
2. Cooler Circuit - cools the IR to Zero degrees C, to make it more sensitive. Has a transistor connected to the back of the case.
3. Detector Circuit

J35 - controls the chopper, detector, etc.

- don't confuse with the blue connector from the middle of the board

VERY UNSTABLE METER

Could be shorted wire from motor. Wiggle J35, the last two pins; black and white are to motor. If bad, resolder.

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CPU BOARD

LOSS OF TIME

Loss of time or display showing impossible data after being turned off without change in EPROMS or CPU is probably a low battery.

BAR DISPLAY

If the display has bars and the cable connection is good, make sure the EPROMS are correctly seated. Always match notch to notch, don't go by the tag - sometimes they are upside down.

BATTERY CHECK

How to check the battery without removing CPU:

1. Keep instrument powered up
2. Remove CPU battery jumper
3. Place lead on CPU ground, the other lead on one of the two left jumper terminals
4. Reading should be 3.6V or higher
5. Replace jumper on the two right terminals

1.999 METER

If you get the 200 mVRMSAC amp setting right and the 120V right and still have a 1.999 meter, it is possible that the CPU is not correctly reading the information. Try replacing the CPU.

EPROMS

4 of them

- U-16, U26, U25, U23 - each contain certain information

If they go bad, you may hear a clicking coming from the instrument, can also get a "Fatal Systems Error 1FFF"

When you replace the EPROMS you will get a 1FFF when you first turn it on, switch it off and then hold the clear button while turning on - U-13 is the clock chip

- X1 is a clock crystal
- X2 is a microprocessor clock crystal

DATAMASTER TROUBLESHOOTING GUIDE

CPU BOARD - cont.

FATAL SYSTEMS ERROR AT F060

If you get this message and it will not clear by holding the clear button and powering up, you likely have a bad "U2" chip. If you are lucky the chip is mounted in a socket rather than soldered in. If you can find another socket mount you can replace the chip, if not you will have to replace the CPU.

FATAL SYSTEMS ERROR AT 1FFF

Could be bad clock chip. U13 controls the clock time, as does the clock crystal (X1).

FATAL SYSTEMS ERROR AT:

F070 - Printer Driver Board
1FFF - Check clock chip
 U23 CPU
3FFF - U24 CPU
5FFF - U25 CPU
7FFF - U26 CPU

WRONG SERIAL

U16 CPU

TEMPERATURE LOW AND/OR HIGH

The two voltage regulators to check on the CPU board are:

VR1 - should be +5V (right), ground is top or center pin

VR2 - should be -5V (right), ground is the left most pin

If these two regulators are not +5 and -5 volts, there may be a variety of problems resulting - replace the CPU.

If either one is off and/or one is very hot to the touch, try unplugging various connections to the CPU. If voltage then corrects itself, that unplugged component is likely bad.

COMPUTER LOCK-UP

Power surges can cause two main problems:

1. Insure solenoids are not locked down or damaged. Extended lockup can result in melting of solenoids.
2. Check printer for proper operation. Lockup can cause damage to PSB through the printer.

DATAMASTER TROUBLESHOOTING GUIDE

CPU BOARD - cont.

NOT CALIBRATED

If you get this message on a calibrated instrument you may try getting a printout of the cal factors. Sometimes the instrument will "find" them during this process.

Check for sticking solenoids

Check CPU battery

To save battery, put jumper on left when not calibrated and turned off.

CRC ERROR E87E

Bad RAM Chip

POWER USAGE

Uncalibrated instrument uses more power from battery (when turned off) than a calibrated instrument does - put the jumper on the left.

DATAMASTER TROUBLESHOOTING GUIDE

POWER SUPPLY BOARD

VOLTAGE CHECKS

To the printer - should be 10-12V, if over 13V change the PSB to prevent damage to the printer board.

To the SCCB - should be 2-3V between TP6 and TP7. The actual voltage is not so important, it is important that the voltage be steady. If the voltage is not steady, replace the PSB.

Check the power output of the PSB by connecting to TP4 and the PSB ground at the middle of the board. Should be putting out 8-10V, if it is a little higher (11-12V) it is probably ok.

Check the voltage between an exposed portion (metal) of the lower case and the PSB ground. No difference more than .05V should be seen - if there is more, the board is not properly grounded. Ground is at center PSB screw.

Check the 7-pin connector, the new ones are gold plated, the old silver ones can cause intermittent and various problems if they are flaky or have burn spots on them.

Most connectors go on real easy, if hard it is probably on wrong.

PROBLEMS AFTER BOARD CHANGES

Check the connectors (push in and squeeze) to Power Supply Board from the transformer.

If the Transformer to PSB connectors are still the old red colored ones, be sure to replace them.

DATA MASTER TROUBLESHOOTING GUIDE

SAMPLE CHAMBER CONTROL BOARD

VOLTAGE CHECKS Voltage must be stable, use TP6 & TP7 to check the lamp. This voltage must be very stable and should vary by only .01 volts or less. Instability can be caused by the sample control board, lamp transistor or power supply board. Lamp voltage should not exceed 4.8 volts. If voltage is over 4.8 volts; path may be obstructed, detector weak, lamp not centered, etc.

If you can't set the .500mv on R34 due to instability, you likely have a bad board

Inability to set the 10mv on R26, check the thermistor, may have wire separation or debris on the thermistor wire.

CONNECTORS

The blue wire to the transistor is in the middle of the transistor, not on the side as on the SCCB. If you have it wrong you will get a -1.999 detector voltage.

If you have a board with a 3-pin J11 and you have a 2-pin connector on the SCCB, use the top 2 pins. If the same thing occurs with J10, use the bottom 2 pins.

Of the two 2-pin connectors, the green-blue one from the breath block goes on top. The gray-gray one goes on bottom.

If temperature high and new SCCB is no help, you may have J9 on upside down.

LAMP VOLTAGE

Check lamp voltage from PSB at pins 5 & 9 on the ribbon connector. Should be 10V.

If lamp voltage varies over time (it should be very stable), don't assume that it is the detector or detector board. Change the SCCB, since it controls the lamp voltage.

SAMPLE ACCEPTANCE

Increase the 500mv or 400mv to 510mv or 410mv

DATAMASTER TROUBLESHOOTING GUIDE

LAMP

UNSTABLE METER Make sure lamp and lamp bracket are secure. Tap lamp and watch the meter. If it doesn't return to +/- .005 of the original setting - replace lamp.

LAMP DOES NOT COME ON When the lamp does not come on and a new lamp or SCCB do not remedy the problem, check the connection to the transistor. Make sure the connections are good and the transistor is properly grounded.

RFI BOARD

VOLTAGE CHECKS If you are having problems with the RFI going off when it shouldn't, set the voltage by turning the potentiometer CCW until RFI is displayed then turn it $1\frac{1}{2}$ turns CW and you should be OK.

Adjust with antenna in place and case as close to closed as possible.

RFI DISPLAYED CONSTANTLY If J24 or CPU is off, you'll get RFI displayed constantly.

MISC. Defective board will result in keyboard problems

DATA MASTER TROUBLESHOOTING GUIDE

PRINTER BOARD

VOLTAGE CHECKS Too much power (over 13v) from the PSB will eventually ruin the printer board, replace the PSB if this occurs.

CONNECTORS Connector from the board to the photo interrupter, looks for the notch on the document. Pull this connector loose from the board and the printer should start running. This is a good way to check the printer, also a good opportunity to oil the shaft.

DARK LINES ON THE DOCUMENT AFTER RIBBON REPLACEMENT You have put the ribbon in wrong.

PRINTER WON'T START/IS SLUGGISH Check photo-interrupter by lifting off J40, the printer should start. If it doesn't, the photo-interrupter is bad.

Make sure red and black wires do not interfere with movement of the head. Tape or clip the wires out of the way.

PRINTER RUNS INTERMITTENTLY WITHOUT A TICKET If the printer CPU and PSB-CPU cable has been checked, then change the photo-interrupter in the printer.

PRINTER ERROR DURING QAP AND TICKET IS PRINTED OK This is an indication that the printer buffer is full. Not a problem, will seldom - if ever occur. Can occur only happen after a run of 10 supervisor tests. Press "ABT" or "CLR" and continue with QAP.

SERIAL NUMBER OK, REST OF INFORMATION AT BOTTOM OF TICKET EPROM problem, replace EPROMS.

DATA MASTER TROUBLESHOOTING GUIDE

PUMP DRIVER TROUBLE

TESTING PUMPS

Pumps can be tested using pump cords/switches used during calibration to tell if a bad connection, board, or pump.

ENDLESS "PLEASE WAIT" AND/OR PUMP RUNS FOREVER

First replace the pump driver board/CPU connector, then try replacing the pump driver board, finally the CPU.

If it is a "lock-up" situation that won't clear, replace the PSB.

DISPLAY

ERROR MESSAGE

Check connection to CPU and to display. If you get an error message, power off and on. If message is gone, may not be a problem.

DARK BAR ON DISPLAY

Make sure EPROMS are all inserted correctly.

Remove DM board, if OK - the DM board is bad and must be replaced.

eje; 7cn

Indicates that the memory is full (most common on training instruments). Turn data collection off and clear memory if dealing with training instrument. On field instruments, have it polled, then clear memory. If the problem persists, you may have to replace the DM or CPU.

METER

METER JUMPY

A meter that is stable, then jumpy could indicate a phase lock loop. Pull off J38 while listening to chopper, if it doesn't speed up or slow down, replace the detector board.

ACETONE WON'T GO DOWN TO .-100 DURING ELECTICAL CHECKS

On older detector board, could be that the photo interrupter needs adjustment. When adjusting the photo-interrupter, you want to adjust it to the most negative meter value.

Replacement of filter or CPU may be necessary

DATA MASTER TROUBLESHOOTING GUIDE

FILTERS

- COLOR** Filters go in with either color side out
- UNKNOWN FILTER** If you have an unknown filter, turn up lamp and hold the filter in the beam:
- Acetone - will black everything out
- Alcohol - about the same amount of light received at the detector
- DIRTY FILTERS** Clean with dish soap, distilled water, isopropanol, allow to dry.

BREATH BLOCK

- MISC.** Watch for wrong setting on the thermistor
- Can get dirty and cause instability when setting the SCCB electricals.

ONE-WAY VALVE

- MISC.** If defective (leaking) you can get "suck back", will get readings like .25 and .00
- Defective valve should be suspected whenever you have a lot of SWZ messages.

DATA MASTER TROUBLESHOOTING GUIDE

DATA MASTER BOARD

CRC ERROR Changing Datamaster Boards will give CRC error, power off and power on.

CRC ERROR AT 800D DM board lost memory. Replace battery

MUST BE SECURE Make sure bracket over DM board and modem board are in place. If not, a board could short against the brass rod.

"4" ON DISPLAY No DM board or bad DM board

GARBLED DATA ON REVIEW Change DM board. If this doesn't solve the problem, replace the clock crystal (CPU).

MISC. Battery low will cause loss of memory (800D). If you suspect a low battery:

- Poll the data
- Turn off the instrument
- Take the Datamaster Board battery off the clip and check it
- Battery should be at 3.5v or more, replace if lower

Connector is best cleaned with a pencil eraser.

MODEM BOARD

DOES NOT POLL Check connections

Check phone lines

Check RFI board connections by connecting phone line directly into modem board

Change modem board

MISC. There are two phone line connections. If you are having hook up trouble, try using the other line connection before replacing the board.

DATA MASTER TROUBLESHOOTING GUIDE

MISC. TROUBLESHOOTING HINTS

Symptom - low readings on certification solution after a good calibration, such as calibrate normally and on a .1000 solution you get consistent readings of .095 - .096 - probably an air leak between the external jar and the sample chamber, if the hoses look good, try a different three-way valve.

Symptom - a reading of -1.999 on the detector voltage, the lamp is not grounding correctly and is probably extremely bright. Check the plate and washer on the transistors on the back. Make sure the transistor is properly insulated.

Symptom - detector voltage of 1.999, all electricals on the detector board check out, including 200 mVRMSAC on R4. If you have switched from a "E" board to a "B" board, the CPU may have a bad chip that prevents it from correctly interpreting the voltage. Put in a new CPU board and it may correct the problem.

Symptom - reading of +1.629 or close to it, on the detector voltage, will be accompanied by a message of "Detector too high". When I had this happen, it was the detector, replaced it and everything was fine.

Symptom - No breath tube heat. Try changing tubes, 98% success rate. If problem not corrected, make sure all connections are good.

Symptom - Long time to say "please wait". Can happen if there is a lot of data on the DM board. Try having the instrument polled, then clear the memory. If polling is unsuccessful you will lose data when you clear memory, if polling is successful you will not have to clear memory.

Symptom - If the instrument is hard to blow into and you have the old 3-way valve, retape the connections. The teflon tape should be applied carefully, don't tighten the connections too far - they can partially block the valve opening.

Symptom - Difficult to blow into, difficulty accepting sample, gives "high speed pump error". Check the voltage across the thermistor while blowing into the instrument. If there is no change in voltage, replace the breath block.

Symptom - Can't adjust potentiometer. If you can't adjust a POT, try turning the other way until you see a change, then turn back.

DATAMASTER TROUBLESHOOTING GUIDE

Symptom - Filters sticking. Filter solenoid shafts can be bent causing filters to stick.

MISC. TROUBLESHOOTING HINTS - cont.

Symptom - Solenoids locked down or filter error, acetone filter doesn't pull in. Most likely need to replace the CPU.

Symptom - Clicking noise coming from instrument, may be followed by a message "Fatal Systems Error at 1FFF". The eproms are going bad on the CPU, order a new set from Seattle BTS and send the old ones in to be checked.

Symptom - Fatal Systems Error at 1FFF when turning the instrument on after changing the CPU. This is normal, turn it off and then hold the clear button when turning back on. If you still get it, you may have the display connector one pin or one row off. If you still get it, you may have an eprom connected improperly or in the wrong spot. If the eproms are properly connected the next thing to check would be try another CPU board, if after changing the board you still have the problem - have a new set of eproms made for the instrument.

Symptom - Fatal Systems Error at 1FFF. If you have checked all the usual things (U23, U16, CPU, PSB) and it still shows the message as soon as you power up (even with the clr button depressed) - it may be the display panel.

Symptom - Noisy chopper motor. Can loosen the set screw on the top of the breath block and move the motor in and out with your finger from behind. Move the motor with the meter on and set it where the meter value is the most negative. If you have an instrument that has for some time had a noisy chopper, you may want to check the wheel housing. The chopper wheel may not be turning the same speed as the shaft because of a damaged shaft or set screw.

Symptom - pump starts to run as soon as you power up after a replacement of the CPU, or the display is blank except for a dark bar across the top - you have one of the eproms inserted wrong.

Symptom - Reading on the display during calibration and just prior to blowing water, usually followed by an abnormally high reading on the water solution. Can check for leaks but it could easily be an electrical problem. Check boards, detector and chopper.

DATA MASTER TROUBLESHOOTING GUIDE

MISC. TROUBLESHOOTING HINTS - cont.

Symptom - unable to get the meter to settle down, erratic readings and general unstable conditions - similar symptoms to an air leak, but no leak. If you have checked the chamber and 3-way and 1-way valves and are sure there is no loss of air, you may want to check the chopper. If it sounds like the chopper motor is not running at a steady speed, it may be a bad motor or it may be that the chopper is not running the same speed as the shaft. May find that the set screw is not making a direct relationship to the shaft, may be just idling at various speeds rather than turning the same speed as the shaft.

Symptom - Suspected leak in the system - try to blow when the display indicates "Ready-Push Run", should not be able to blow into the breath tube. Take the hose off the three-way valve and take the hose off the other end of the chamber, blow through the one end and see if any air leaks out - should not be able to blow through it. It will show you where the leak is if you can blow through it. Can also check it with the display says "Please Blow" - try to suck back, you should not be able to suck back and make the please blow stop flashing.

Symptom - After you push the run button a "4" is displayed on the screen. This usually means that the datamaster board is bad. Could also indicate bad CPU.

Symptom - The RFI goes off as soon as you hit "meter" or the printer starts whenever you key a portable near the instrument. Try to set the RFI the alternate manner. Turn the adjustment CCW (with the meter on) until RFI is displayed, then turn it 1 and 1/2 turns CW and you should be set correctly and the problem solved.

Symptom - Will not accept password during calling attempt. If all the normal things (modem, CPU, eprom) have not helped; try replacing the Data Board. It is necessary for the modem and data boards to work together and in rare instances, replacing one of the two may result in a mismatch and it won't work.

Symptom - Invalid Sample. Check the one-way valve, should be able to breath out through tube and valve, but not suck back.

Symptom - continual Invalid Sample. If all the usual checks fail, it may be that a piece of gasket is loose in the chamber. This should especially be suspect if the invalid seems to occur most when you blow hard into the instrument - enough force to cause it to blow in the wind.

DATAMASTER TROUBLESHOOTING GUIDE

MISC. TROUBLESHOOTING HINTS - cont.

Symptom - poor precision despite excellent electrical condition. Could be the external standard pump, worn baffle can cause varying degrees of suction.

Symptom - system won't zero and invalid sample problems to the point that a test cannot be run, accompanied by a hum coming from the inside of the instrument in the area of the detector block. Usually you can feel a vibration on the modem speaker. If this happens it is the PSB, the settings on the SCCB will also be off.

Symptom - extremely high reading on known solution, then SWZ. Check for lamp vibrations, check lamp for stability.

EPROM CONTENTS:

- U23 - Service routines; math, printer, display characters, communication, modem.
- U25 and U26 - breath test sequence and machine interfaces
- U16 - Power up vectors (alpha or numeric on keyboard), data prompts

Gasket material - not all mirrors have gasket material around them. No gasket is better if there is no leak. Clean with warm water. Be very careful when cleaning the mirrors, you can easily rub off or blemish the mirror surface.

When replacing the transformer for whatever reason, be sure to check the plugs for proper wire sequence. If one of the wires is in wrong you can shoot high voltage through the whole instrument and likely blow the rear transistor after damaging several boards.

To check the detector and board in relation to the lamp: On the new lamps you can hook up to the rear connections and take a reading, this is similar to taking a reading off the SCCB. The reading should be around 4V, 3.5 is fine, 4.5 is getting too high. This is good way to see if the lamp is putting out light - could tell you that the problem is at the detector end.

If the light has to be quite bright in order to get the detector voltage to -100, try adjusting the lamp bracket so as to achieve the most negative detector value. Then re-adjust the R16 to -100.

DATAMASTER TROUBLESHOOTING GUIDE
SIMULATOR

PURPOSE

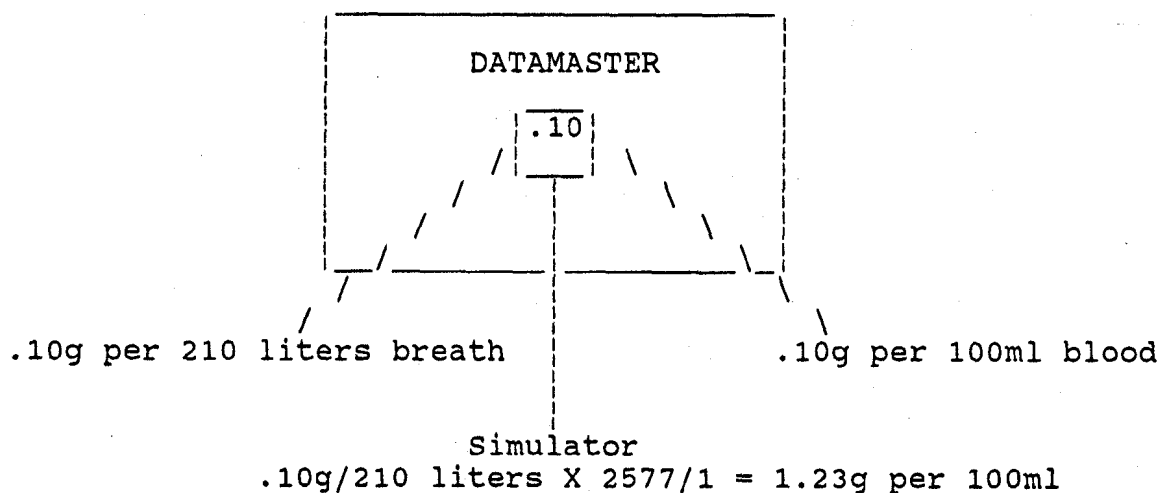
1. Provide a standard for each test
2. Check and certify the instrument with each test
3. Address the RFI issue - shows any effect if it would be present

ADJUSTMENT

1. Unscrew the cover and adjust the potentiometer
 - is glued down but will turn
 - rectangular in shape
 - clockwise to lower the temperature
 - counter-clockwise to raise the temperature
 - as you turn counter-clockwise slowly, the temperature light should come on
 - is a very delicate adjustment
2. Some simulators will have a fine and a course adjustment, two potentiometers

RATIO OF 2577-1 AT 34 DEGREES C.

- to allow for water to air difference



DATAMASTER TROUBLESHOOTING GUIDE

REPAIR/TROUBLESHOOTING GUIDE - SIMULATOR

Guth simulators are equipped with a RFI detector. This detector shuts off the simulator heater until the source of the RFI is eliminated.

A. Motor

When the simulator paddle freezes you should replace the motor. This will require soldering the appropriate wires.

There are occasions where oiling the motor at the shaft connection will unfreeze the motor. Would not recommend this on a field instrument, the motor would have to be monitored carefully for several days - it could freeze again.

B. Unstable Temperature

This can be caused by split brushes on the potentiometer.

1. Turn the simulator off and turn the potentiometer all the way to the end. You will hear a clicking noise.
2. Turn the simulator back on and adjust the temperature back to 34 C

Stuff growing on the thermostat can also cause temperature fluctuations.

Clean simulator with a solution of bleach and water. Use one teaspoon of bleach to one quart of water.

Failure of the potentiometer can also cause temperature problems. Guth has recently changed from a wire wrapped potentiometer to a ceramic one.

1. Warm simulator to 34 C
2. Tap potentiometer lightly with a screwdriver, if the temperature jumps - replace the potentiometer

C. Simulator Will Not Heat

In most instances, you should replace the simulator and sent the defective one to Electronic Services for repair. If you have the time/want to repair it yourself, you can check the following:

1. Is the board wet? Dry it off.
2. Thermistor voltage (white wires) should be 121V AC, check it with the multimeter.
3. Heater voltage (red wires) should be 1.3V DC
4. Is the resistance through the heater 0 or infinite? If so, replace the heater. If not, replace the Guth chip.

D. Erratic Readings

It is possibly caused by air leaks in the simulator.

1. Check for the presence of an O-ring in the head of the simulator.
2. Check for air leaks around the thermometer, Teflon tape the screw if necessary.
3. Check for air leaks around the motor screws, remove and Teflon tape.

E. Temperature Readings High

If the solution reads very high, check to see that there are no breaks in the mercury in the thermometer.

1. Follow instructions in the Guth manual for correcting breaks in the mercury. May first want to try complete cool down and re-heat while thermometer is removed.

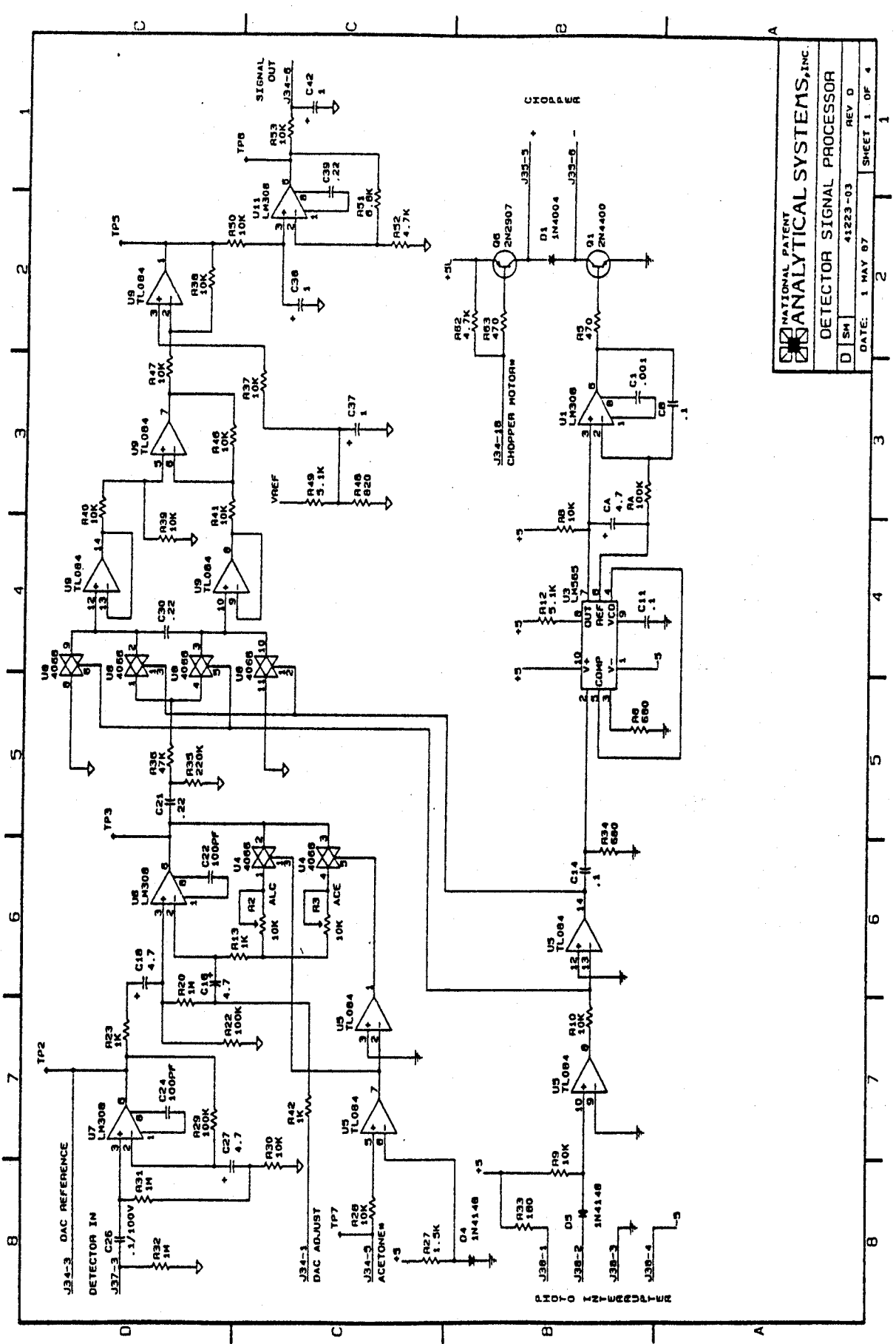
F. Misc. Hints


1. Store spare thermometers upright to discourage mercury from separating.
2. The simulators that have two pots - the left one is fine. Remember that CCW heats.
3. If persistent leak problems:
 - check for cross threaded jar
 - could be a bad jar, will not seal
 - be sure the O-ring is present
 - check if some of the nuts/bolts/screws loose

DATAMASTER TROUBLESHOOTING GUIDE

Misc. Hints - cont.

4. Lube the propeller shaft every two months, use Hoppes - no lock-eze
5. Can clean the thermo regulator by slipping a test document through the slot
6. To clean the simulator - use a solution of 1 quart water and 1 teaspoon of chlorine bleach for 15 minutes.



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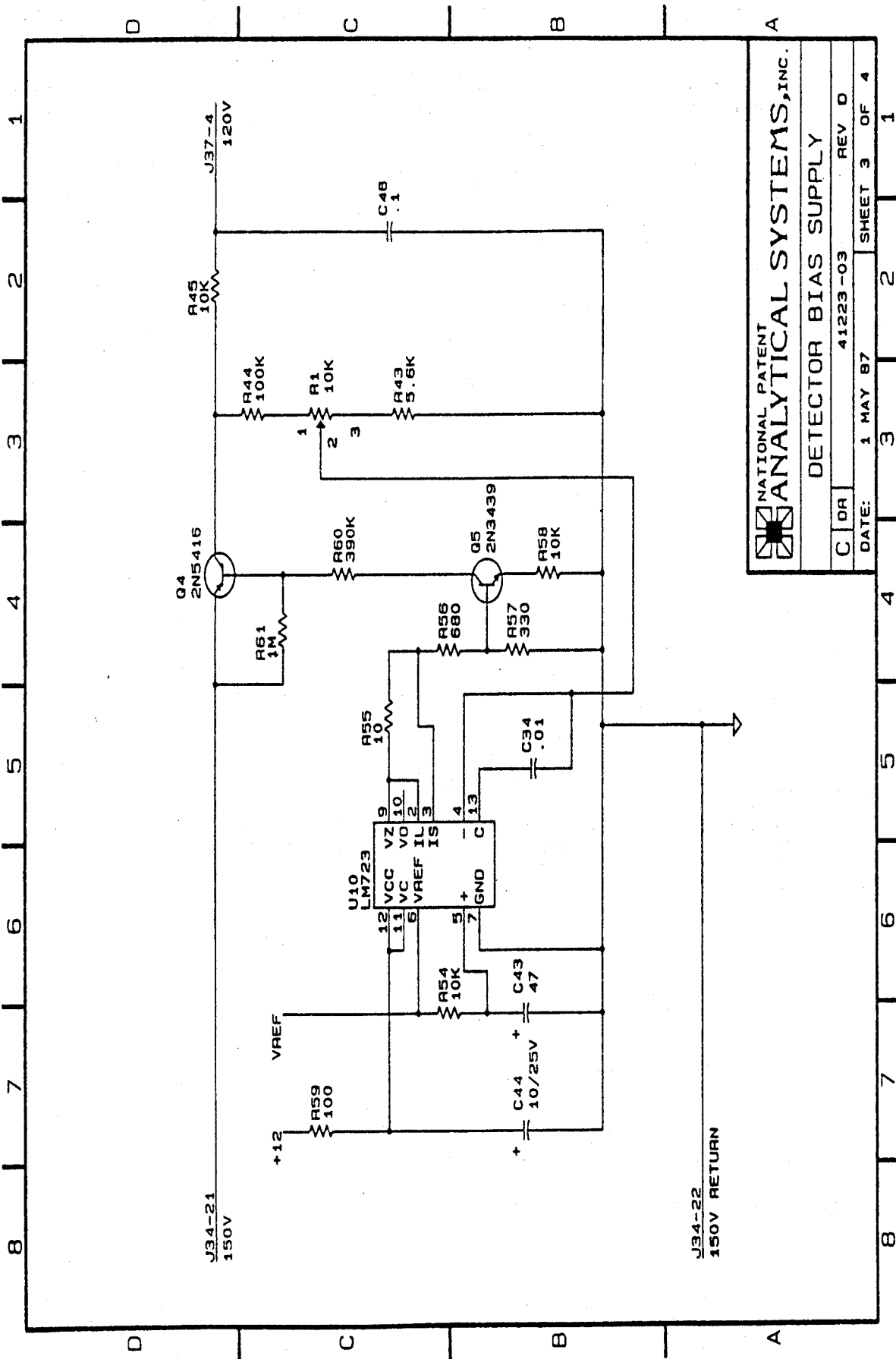
DETECTOR SIGNAL PROCESSOR

D | SM | 41223-03 | REV D

DATE: 1 MAY 87

SHEET 1 OF 4

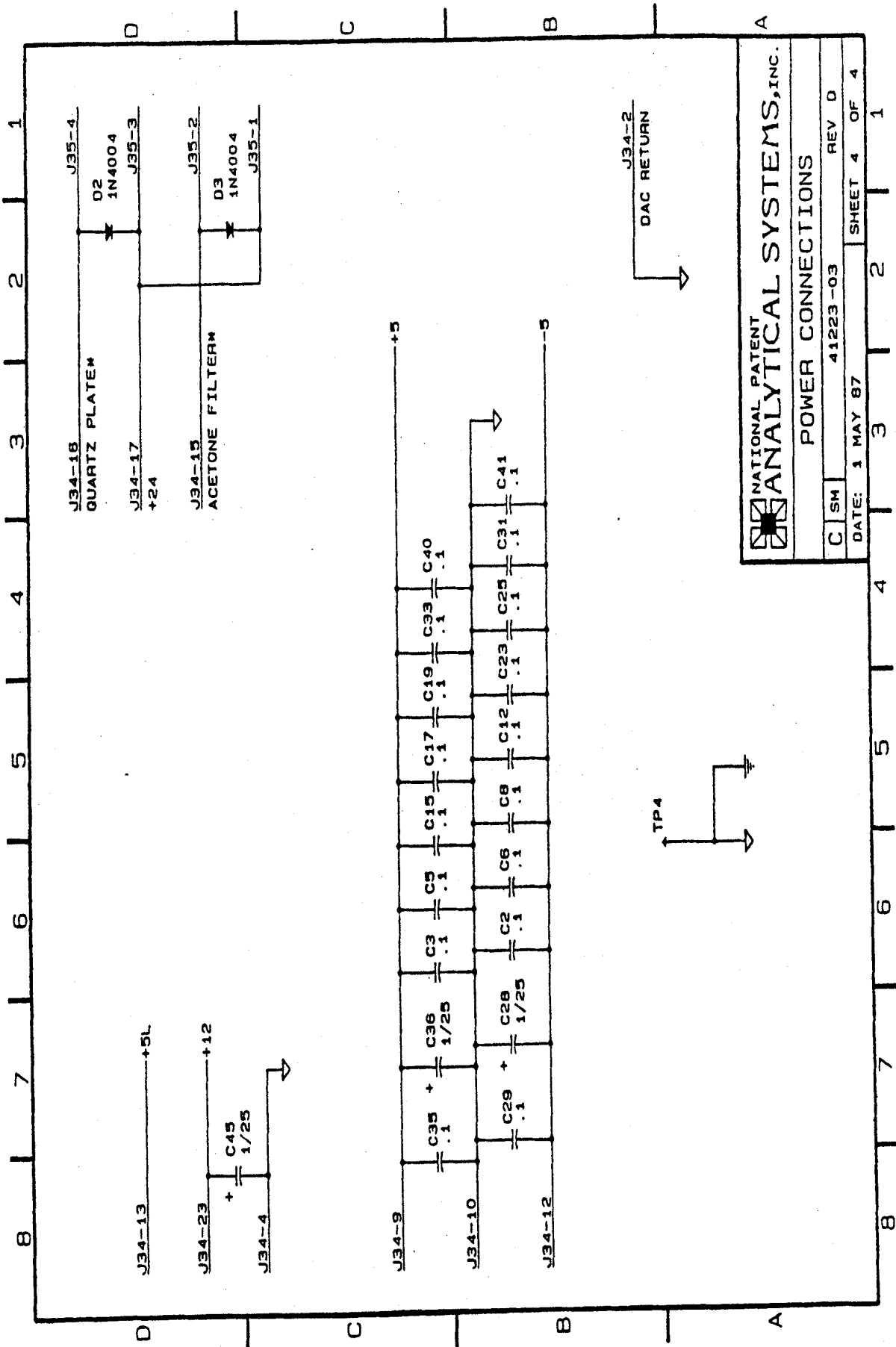
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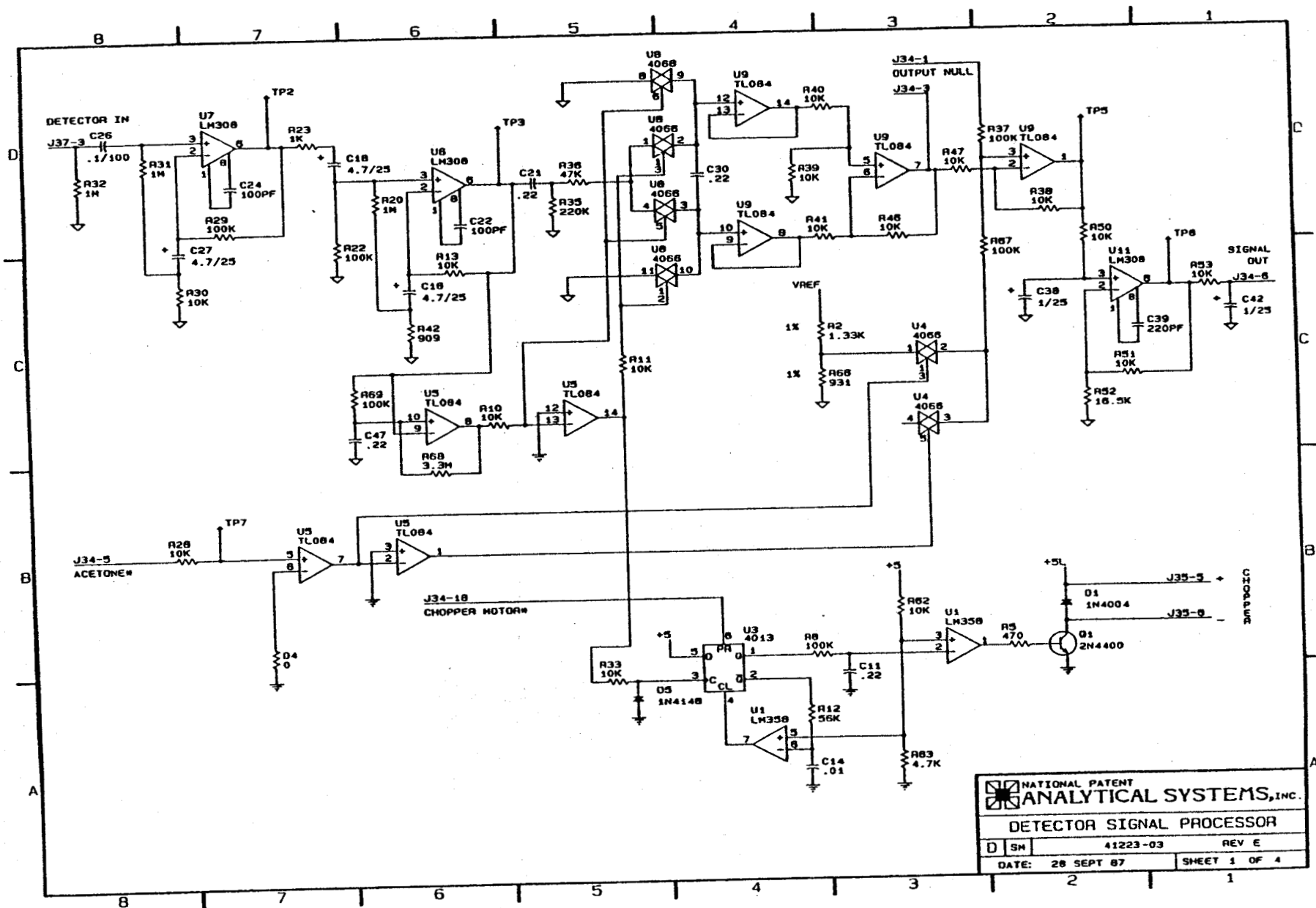
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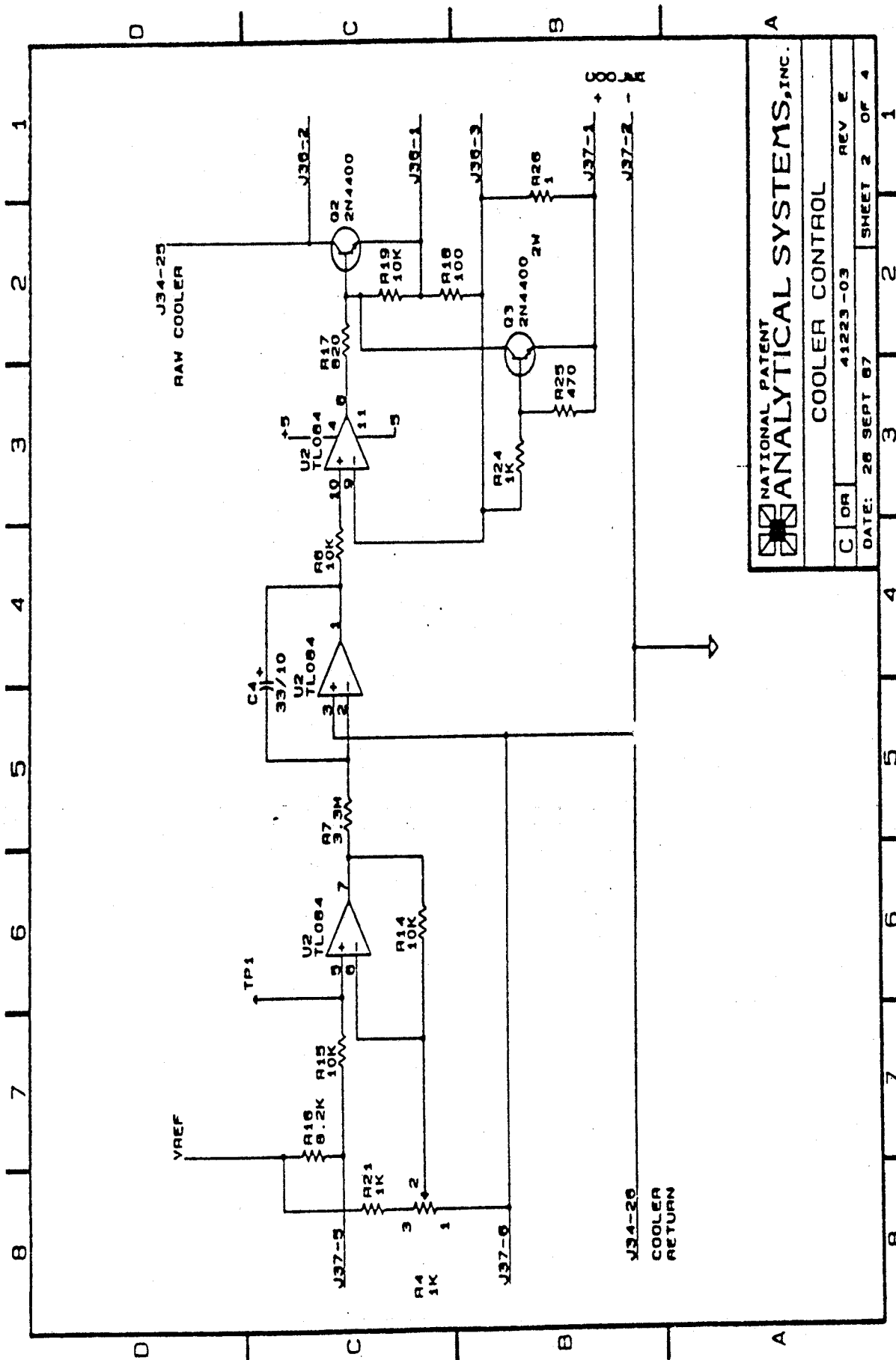
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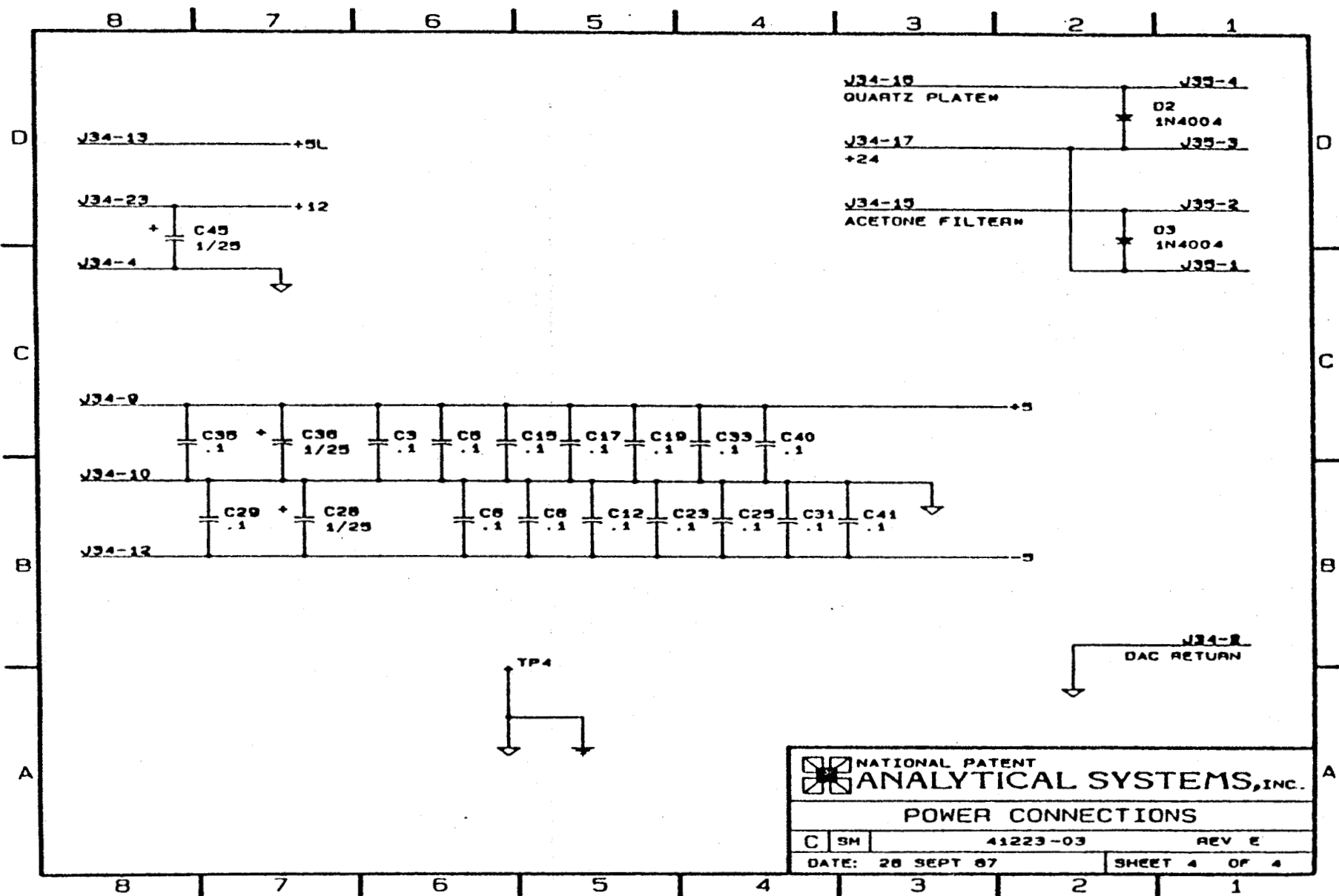


NATIONAL PATENT ANALYTICAL SYSTEMS, INC.	
POWER CONNECTIONS	
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SHEET 4 OF 4	





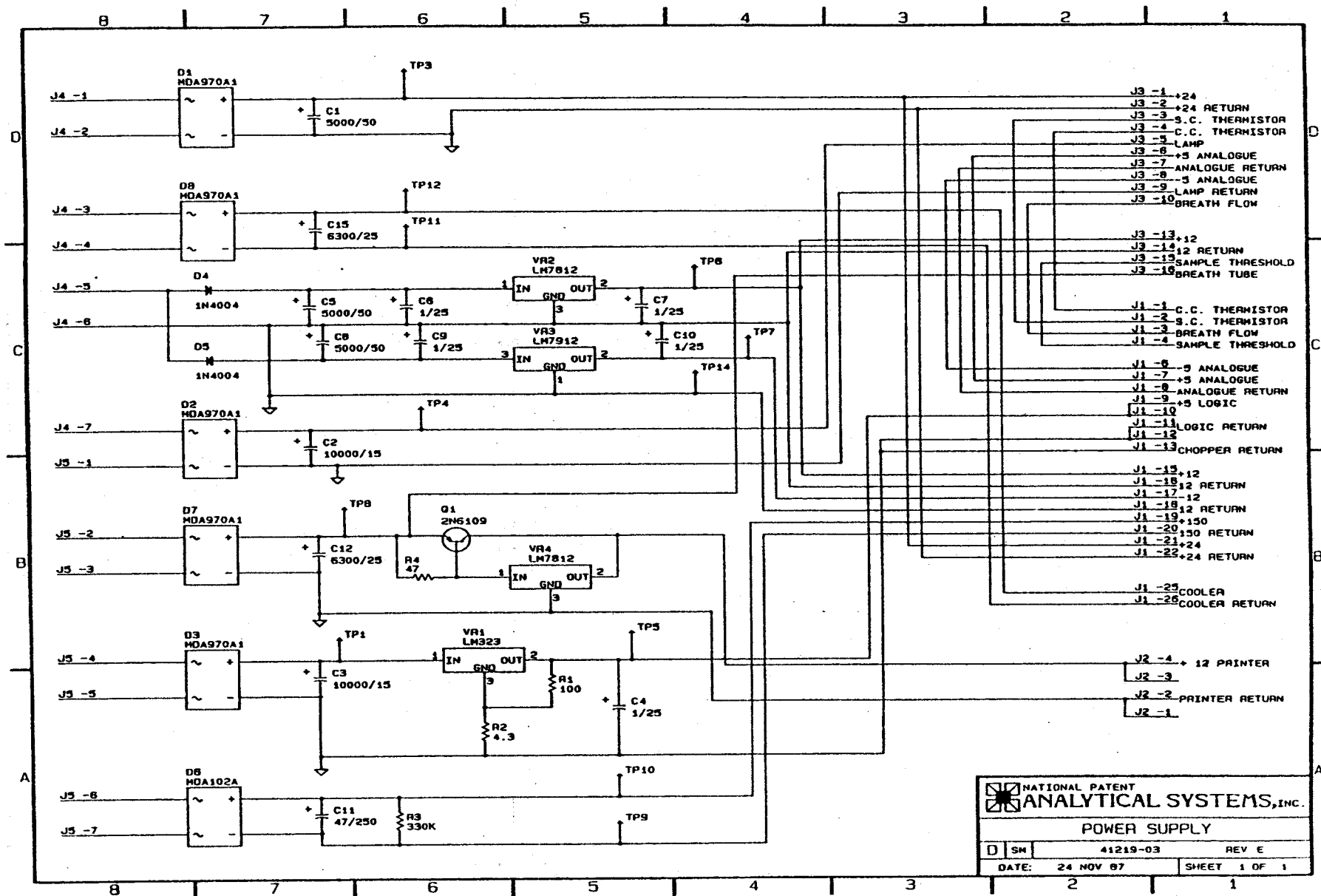
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COOLER CONTROL		REV E	
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DATE: 26 SEPT 67		1	



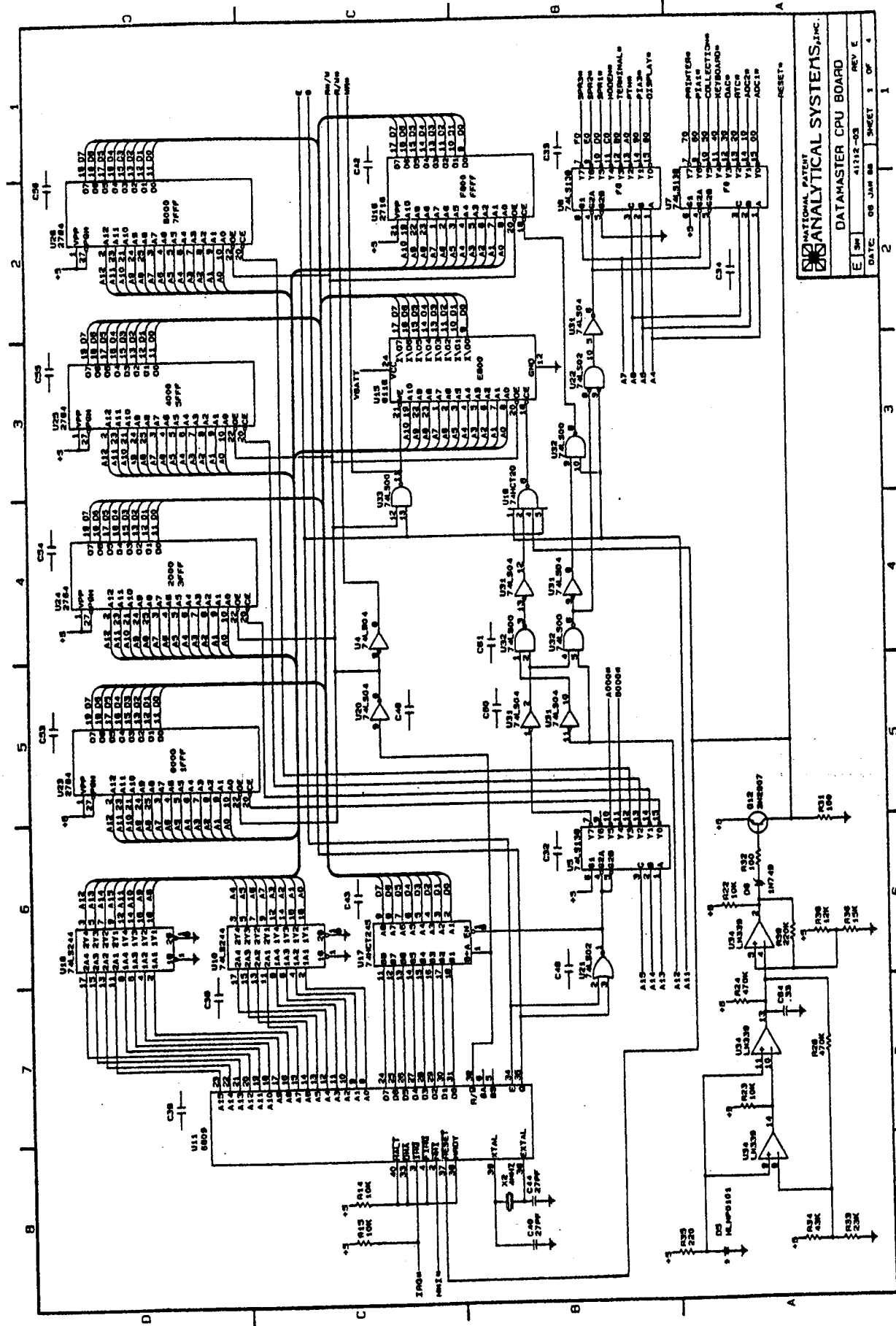
NATIONAL PATENT
ANALYTICAL SYSTEMS, INC.

POWER CONNECTIONS

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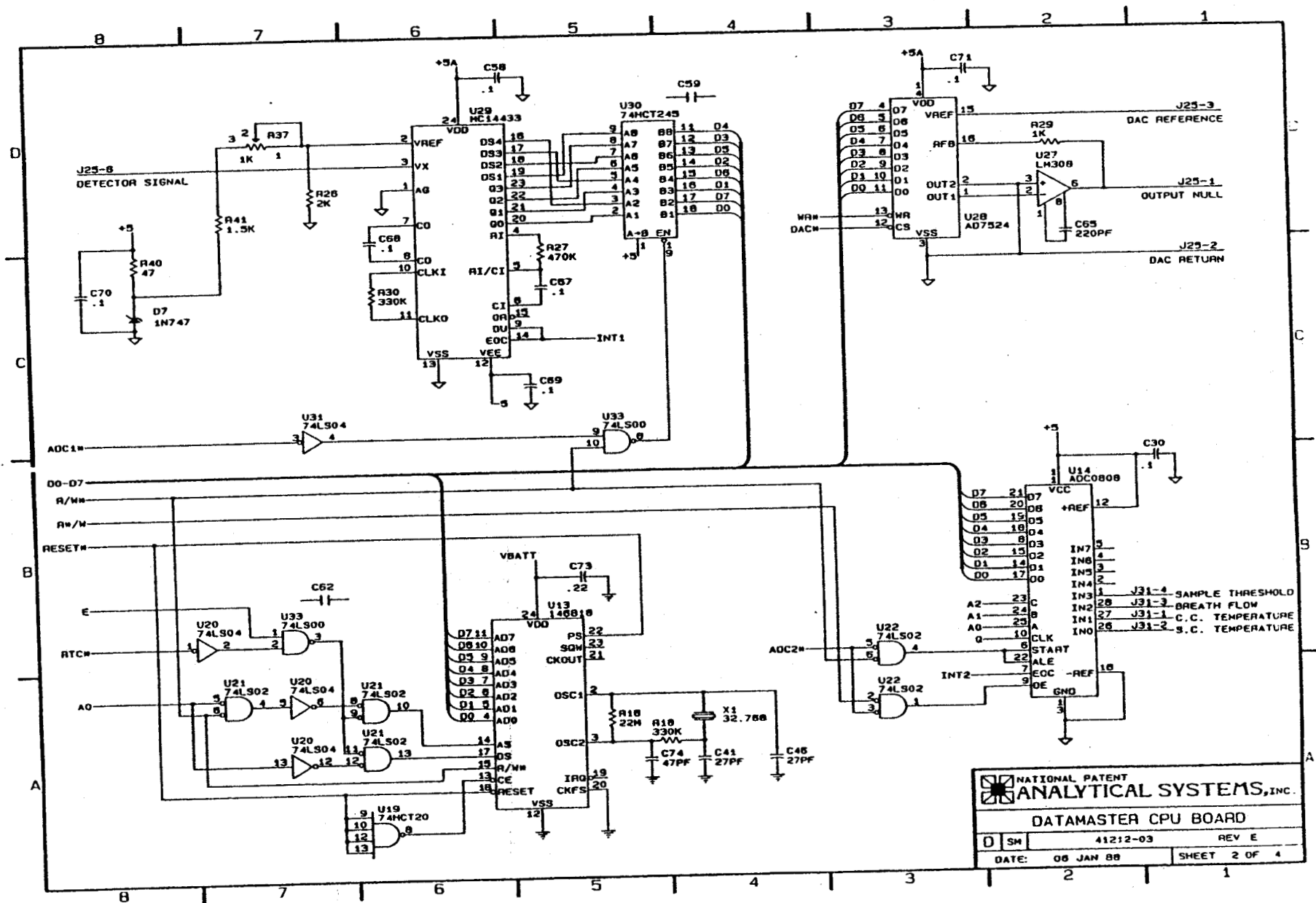


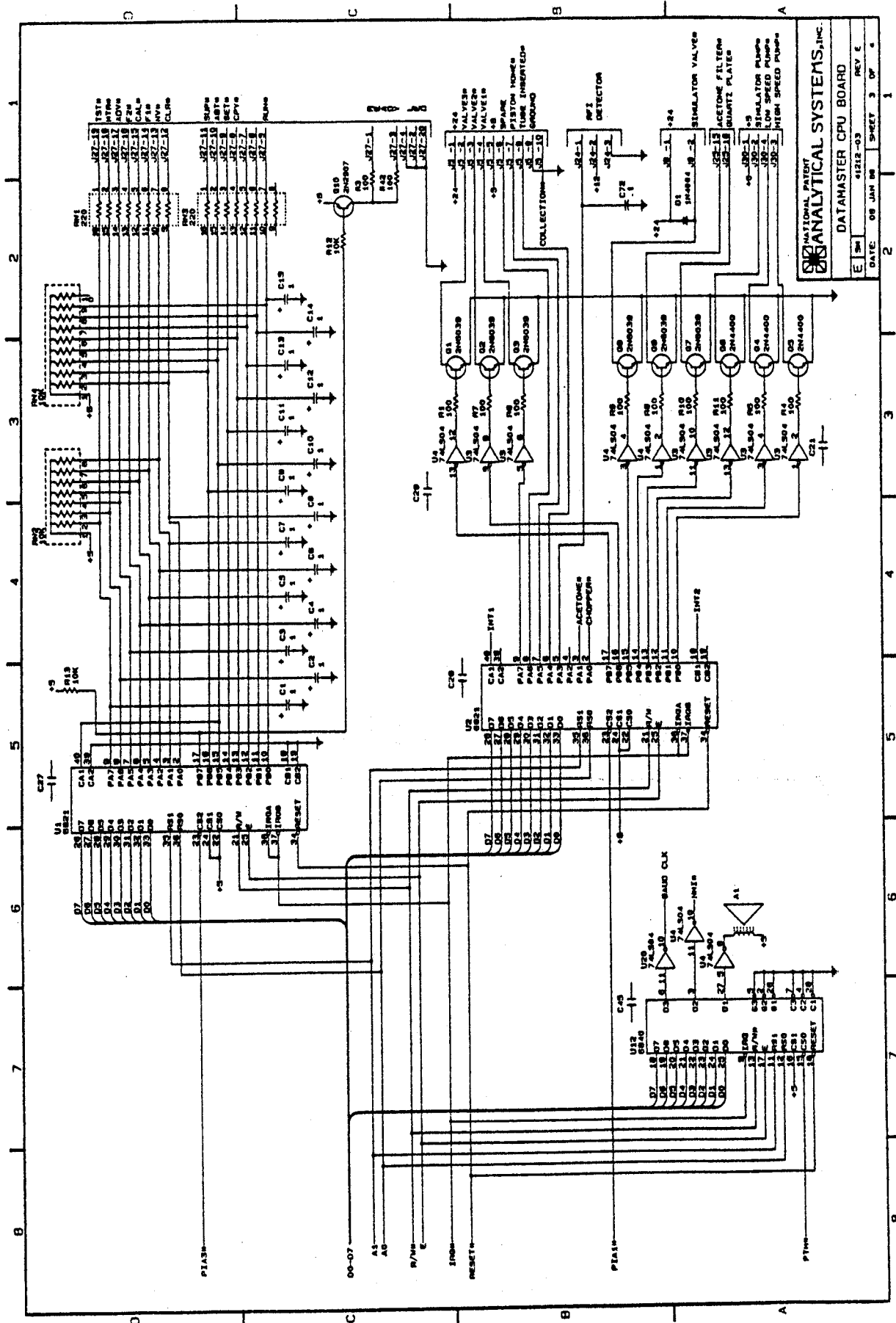
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POWER SUPPLY			
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DATE:	24 NOV 87	SHEET	1 OF 1

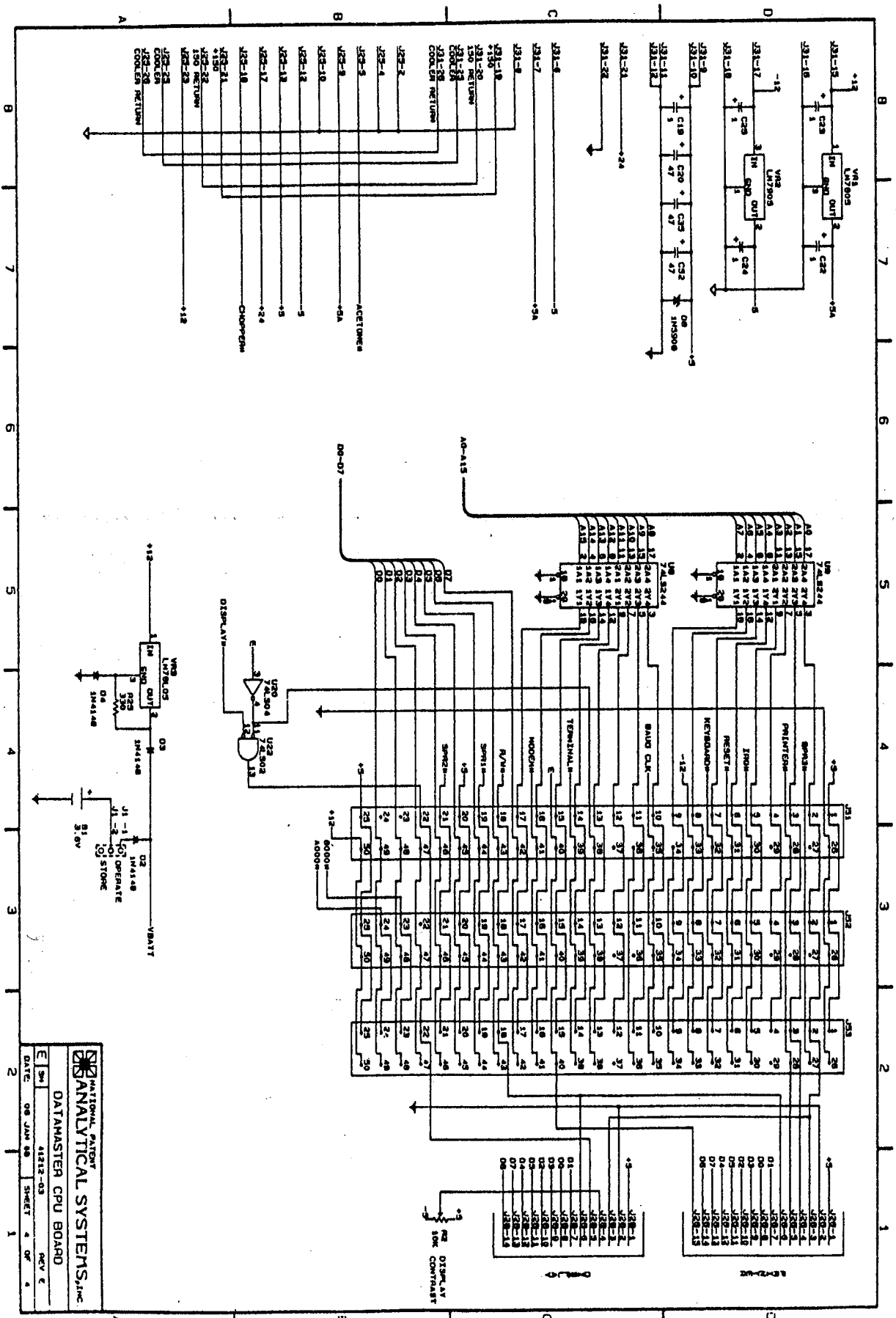


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DATAMASTER CPU BOARD

DATE	08 JAN 88	SHEET	1 OF 4
REV	4	REV	C





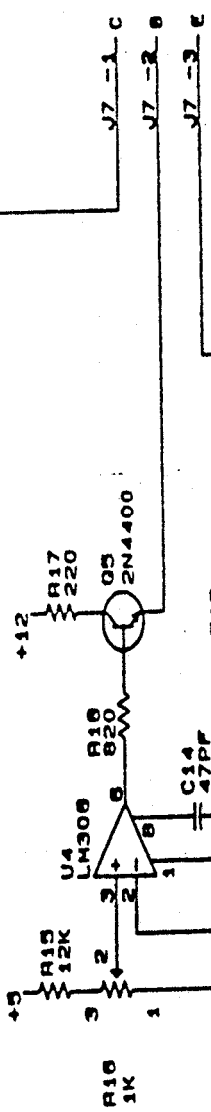


8 7 6 5 4 3 2 1

TP7

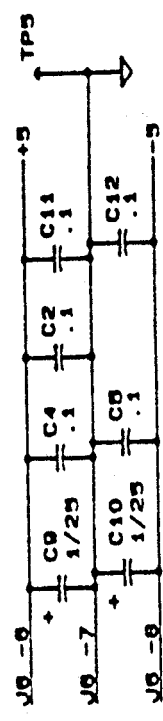
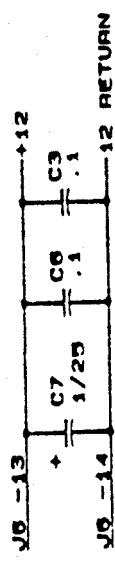
J6 -5
LAMP

J6 -1
J6 -2



J6 -9
LAMP RETURN

B

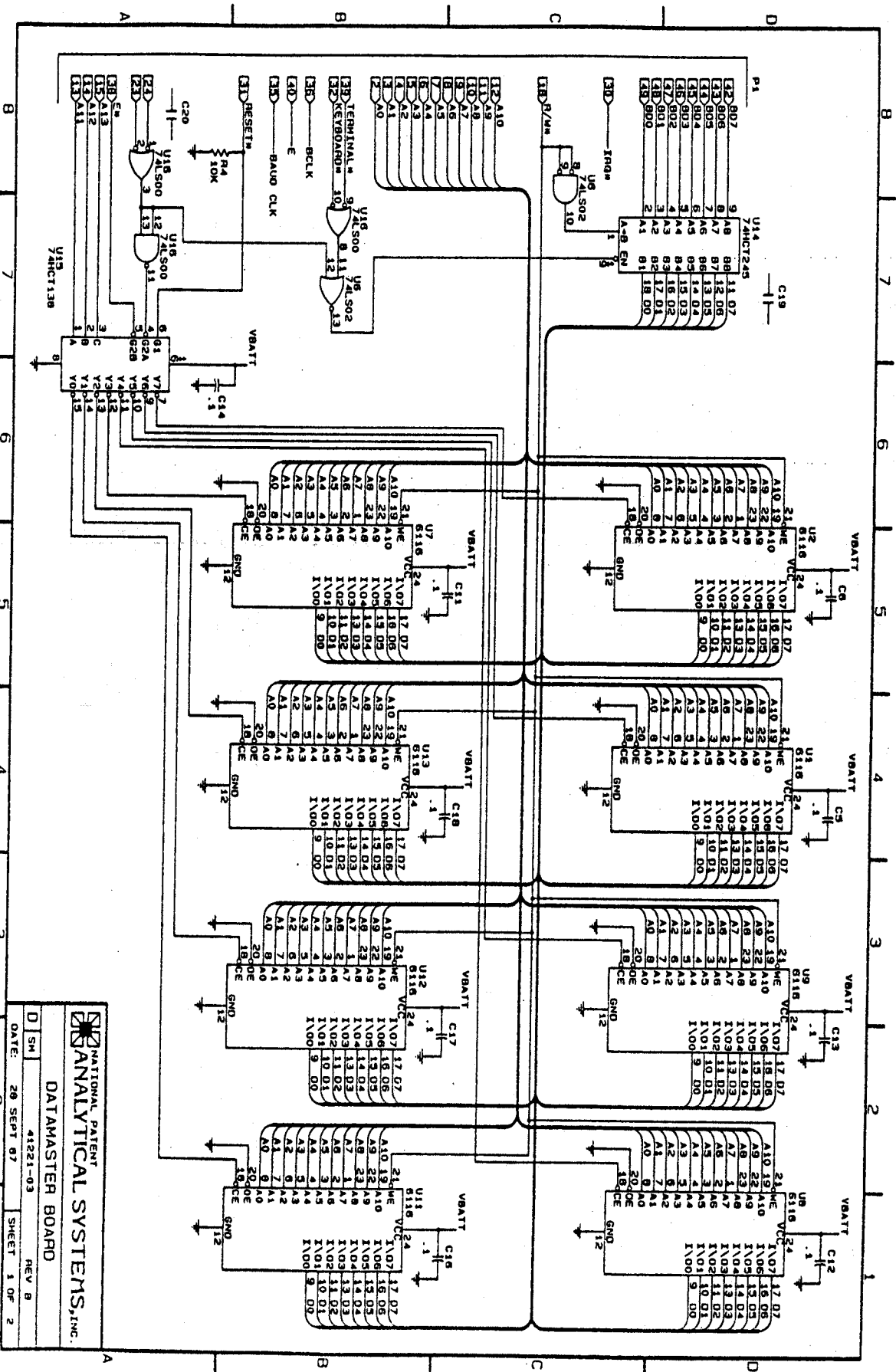



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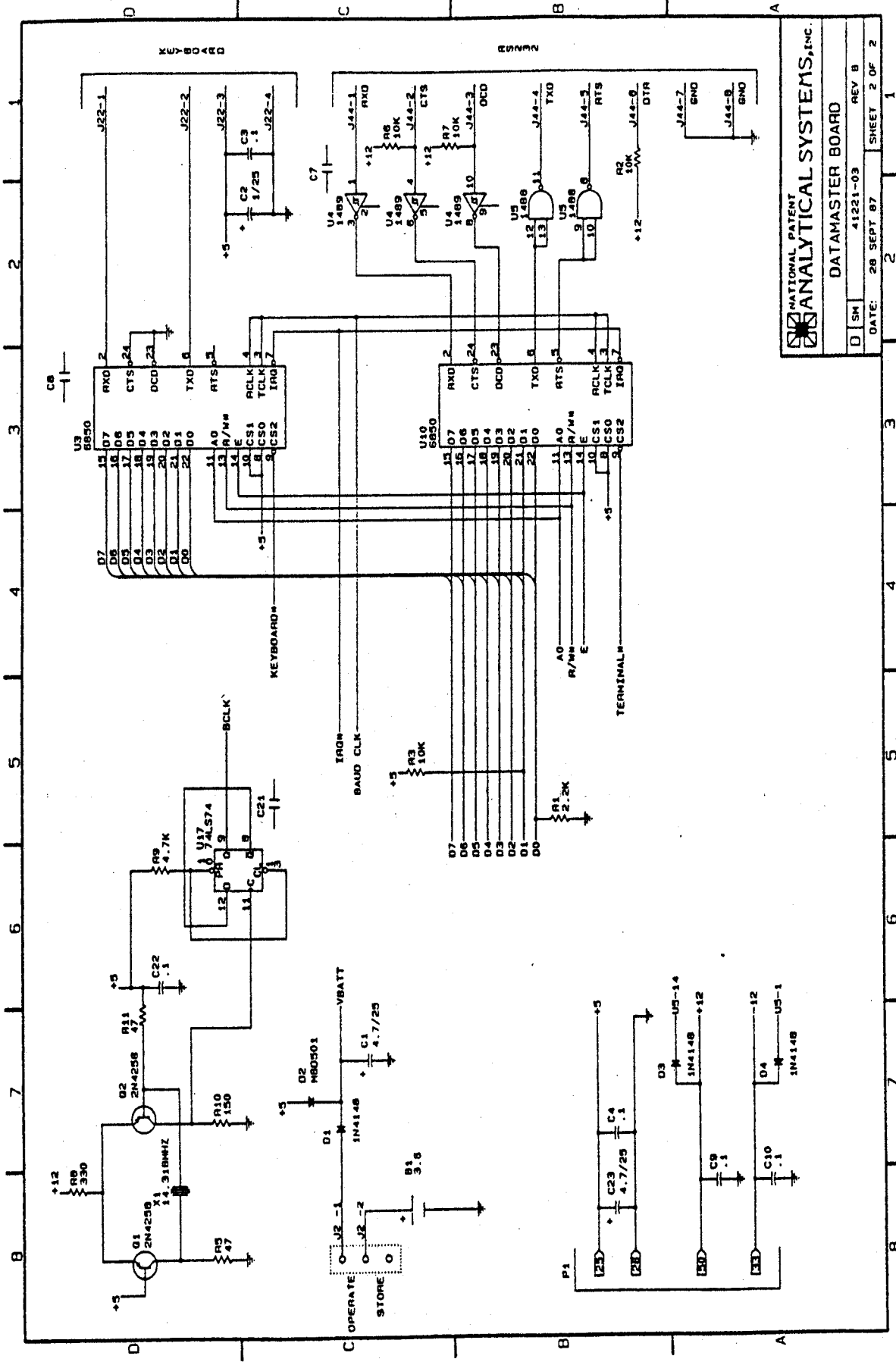
LAMP SUPPLY

C	SM	41225-03	REV B
DATE: 8 DEC 87		SHEET 3 OF 3	

8 7 6 5 4 3 2 1




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DATAMASTER BOARD
 D 5M 43221-03 REV B
 DATE: 26 SEPT 67 SHEET 1 OF 2



**NATIONAL PATENT
ANALYTICAL SYSTEMS, INC.**

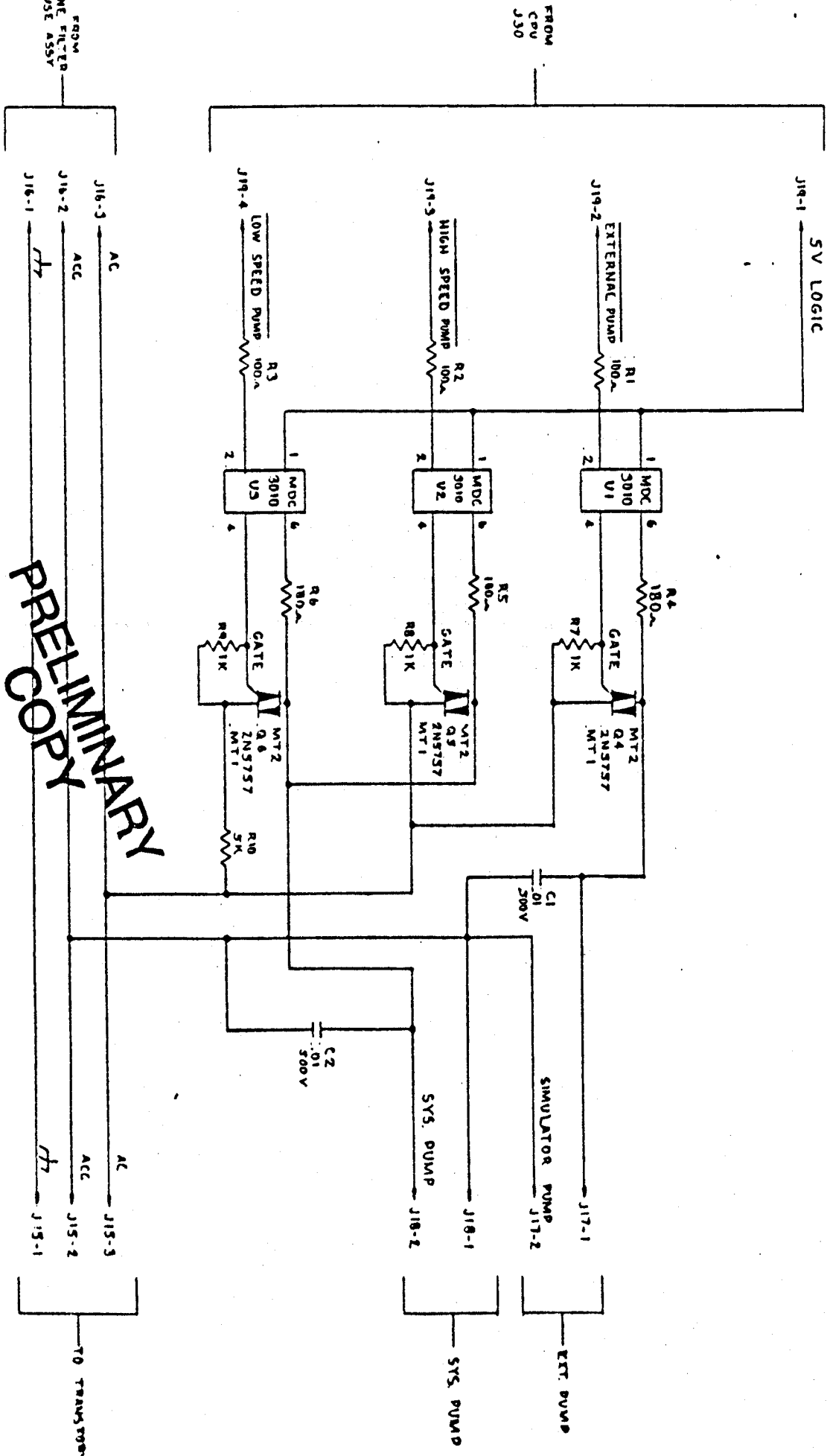
DATAMASTER BOARD

REV B

DATE: 28 SEPT 87

SHEET 2 OF 2

A	UPDATED AS SHOWN	23-86 (Rev. 2)
B		



PRELIMINARY

UNLESS OTHERWISE SPECIFIED

REWORK ALL SURFACES & SHAPE EDGES FROM MACHINED SURFACES

MANUFACTURING TOLERANCES

ICM DIMENSIONS	METRIC DIMENSIONS	ELECTRICAL
0.001 INCHES	0.0254 MM	RESISTORS IN OHMS
0.002 INCHES	0.0508 MM	CAPACITORS IN P.F.
0.003 INCHES	0.0762 MM	TOLERANCES 5%
0.004 INCHES	0.1016 MM	
0.005 INCHES	0.1270 MM	
0.006 INCHES	0.1524 MM	
0.007 INCHES	0.1778 MM	
0.008 INCHES	0.2032 MM	
0.009 INCHES	0.2286 MM	
0.010 INCHES	0.2540 MM	

VERAX SYSTEMS INC. DESIGNED BY R. MCCOY

SCALE: NO SCALE

DRAWING SIZE: C

DATE: 10/1/86

REVISION: 1

PROJECT: PUMP DRIVER BOARD

01230

